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ETHNOLOGY.—The Motilones: Some untouched tropical forest peoples in northwestern South America.[1]

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The term *Motilon* has little demonstrable ethnological significance. It evidently derives from the Spanish verb *motilar* and refers to the cropped head hair of some of these Indians. The name appears early in the Spanish historical accounts (Jahn, 1927, p. 45; Nicolas de la Rosa, 1945, pp. 202, 258, 275), where it had much the same usage it has today, namely, as a generic term referring to the Indians inhabiting the Sierra de Perijá. In this paper we shall not go into the rather literary complexities that have resulted from attempts to give names to the various hypothesized subunits of the Motilones. The actual existence of these smaller divisions is speculative until further ethnographic data are available. For a discussion of the confusing question of Motilon "tribal" names the reader is referred to Jahn, Reichel-Dolmatoff, and the Motilon article by Métraux and Kirchhoff in the forthcoming Handbook of South American Indians. For our purposes two general ecological divisions, Highland Motilones and Valley Bottom Motilones, will suffice, reducing the whole problem of nomenclature to its simplest terms. We shall consider de Booy's *Tucucu* and *Macoa*, Bolinder's *Motilones*, Jahn's *Chake*, and Reichel-Dolmatoff's *Yuko* to be in the category Highland Motilones. Jahn's *Mape* and Reichel-Dolmatoff's *Kunaguasaia* are included in our designation Valley Bottom Motilones. When it becomes necessary to suggest further subdivision geographical designations will be used.

The Motilones are an enclave of tropical rain-forest Indians inhabiting the jungles of the Sierra de Perijá in northeastern Colombia and northwestern Venezuela. Their territory includes the two distinctive environments that form the basis for the classification made above. Although it has been possible for at least 20 years to visit or study the Motilones who live in the Sierra de Perijá above an elevation of 2,000 feet, the Motilones who dwell lower down along such rivers as the Catatumbo, de Oro, and Santa Ana have remained isolated from any outside contacts except those of a violently aggressive nature. These unfriendly, unknown, and isolated Valley Bottom Motilones were our subject of major interest during an ethnographic field trip that we made for the Department of Anthropology of the American Museum of Natural History from March to December 1946.

The Sierra de Perijá is a northern extension of the main Andean Chain and serves to divide the great Maracaibo Basin on the east from the Magdalena Basin to the west. The mountains are composed of extremely tilted sedimentary beds, which exhibit considerable dissection (Notestein, 1944). The thrusts involved in the tectonic movements seem to have come from the east and resulted in a rather gently sloping and much-contorted eastern face rising from the Maracaibo Basin flats to heights of over 6,000 feet at such central peaks as the Cerros Bobali. From these crests the western slopes plunge almost vertically into the Magdalena River bottoms.

The prevailing winds of the region pour southeastward from the Caribbean across Lake Maracaibo. The warm, thoroughly

[1] Read before the Anthropological Society of Washington, March 18, 1947. Received May 8, 1947.

saturated air masses flow upward along the eastern face of the Perijá to deposit their constituent tons of water content in the form of almost continual torrential downpours as they encounter cooler air strata. Although there are roughly two semiannual peaks of rainfall incidence interrupted by so-called dry seasons during the periods from January to March, and July to September, the country never really dries out. Rainfall records from areas near the confluence of the Ríos de Oro and Catatumbo show an annual average precipitation of 190 inches (Notestein, 1944, p. 1169). These figures represent conditions on the eastern periphery only; rainfall in the heart of the upper drainage systems of the rivers is considerably heavier.

Two results of these conditions are apparent from even the most cursory air-examination of the Perijá. In the first place, the whole eastern slope is blanketed with a dense, unbroken cover of tropical jungle. A second consequence, while not so obvious, is of even greater significance for the ecological adjustments which the Indians have made and contributes materially to their isolation. The already contorted surfaces of the eastern slopes have been further dissected by heavy water run-off and now exhibit a dendritic complex of tortuous streams flowing through narrow, steep-sided valleys of considerable gradient, depositing alluvial fans wherever their flow is impeded by frequent rapids and shoals. All these factors make the intermontane areas difficult of access. To the east of the outlying foothills the streams become large navigable rivers, which meander slowly across the level alluvial plains of the Maracaibo Basin. The peripheral sections are, therefore, easily accessible by water transportation from Lake Maracaibo. Once the hill country is entered, however, the only feasible means of travel is by shallow-draft launch during the high-water periods.

The eastern rim of outlying foothills, where the character of the streams and the country changes abruptly, is precisely the eastern limit of Motilon occupation. As we shall see, their location is principally attributable to the fact that these higher streams have easily defensible spurs and an abundance of arable alluvial basins ideally suited for the type of horticulture practised by the riverine Motilones. To the north and west in the mountain areas above 2,000 feet the Motilones have made another ecological adjustment. Thus the whole mountain mass of the Perijá from the line Codazzi–Machiques on the north to the South American Gulf Oil Co. pipeline and service road on the south is effectively held by the Motilones alone.

It is fairly certain that these peoples have opposed penetration by outside groups from the earliest times. Certainly the Conquistador Alfinger left the Motilones strictly alone when he made his great raiding trip in 1530 from Maracaibo northwest around the tip of the Perijá, then south through Valledupar and Tamalameque to La Gloria, where he turned southeast toward Pamplona, only to be killed by Indians somewhere in the neighborhood of Chinacota.[2] Uprisings of Motilones along the Río Zulia occurred as early as 1588 (Vazquez de Espinosa, p. 324). In an account dating from the early seventeenth century, Simón describes an encounter between the Motilones and Alonso Pérez de Tolosa in the Valley of Cúcuta, which differs little from conditions applying today in regions only 100 miles to the northwest (Jahn, 1927, pp. 59–60; Oviedo y Baños, 1885, vol. 1, p. 209).

There are references to attempts to missionize the Motilones throughout the succeeding centuries (Jahn, 1927, pp. 62–72; Salas, pp. 232–233; Nicolas de la Rosa, 1945, p. 275 ff.), and recently a Catholic Mission near Machiques, Venezuela, and the Protestant Evangelical Union of South America at Santa Marta, Colombia, report that they have established contact with Highland Motilones. While all the details of these efforts are far from clear, it is fairly certain that they have mostly been unsuccessful.

The reasons behind resistance to missions are probably those underlying Motilon resistance to acculturation of any sort. De la Rosa's summary from the early

[2] Castellanos, parte ii, elegia i, canto 4, 207–208. See also translation in Hakluyt Society, No. 28: vi–vii.

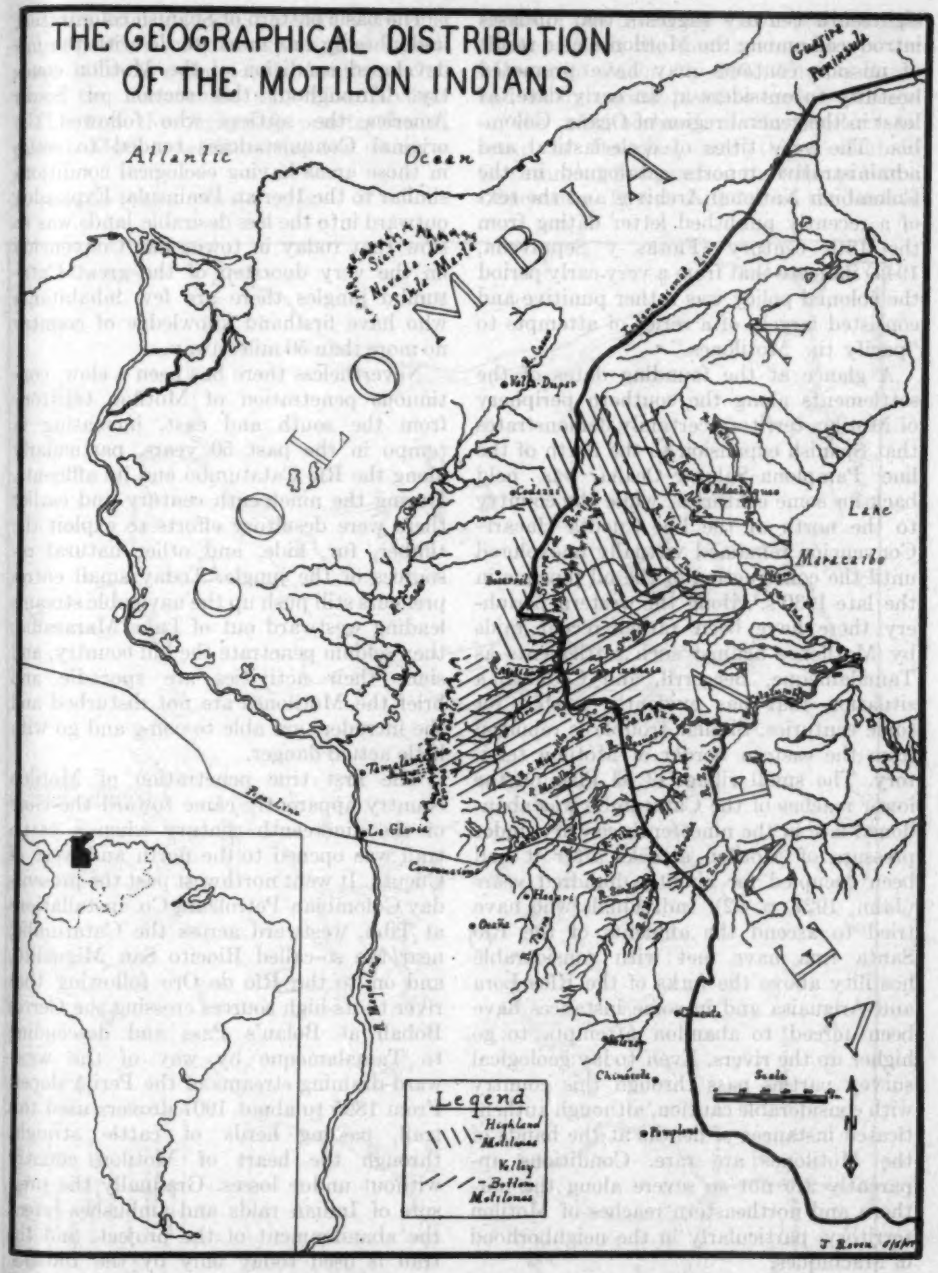

FIG. 1.—Distribution of the Motilon Indians.

eighteenth century suggests that diseases introduced among the Motilones as a result of mission contacts may have promoted hostility to outsiders at an early date, at least in the general region of Ocaña, Colombia. The very titles of ecclesiastical and administrative reports catalogued in the Colombian National Archives and the text of a recently published letter dating from the 18th century (Flotas y Sepulveda, 1944) indicate that from a very early period the colonial policy was rather punitive and consisted largely of a series of attempts to "pacify the Motilones."

A glance at the founding dates of the settlements along the southern periphery of Motilon territory certainly demonstrates that Spanish expansion to the north of the line Pamplona–Salazar–Ocaña was held back for some centuries, while the country to the north of the line Cúcuta–Hacari–Convención remained virtually unexplored until the construction of the oil pipeline in the late 1930's.[3] Along the western periphery there have been rather recent raids by Motilones against such settlements as Tamalameque, Beccerril, and Codazzi, a situation that has evidently existed for some centuries. Similar trouble is reported from the eastern border of Motilon territory. The small village of El Pilar on the lower reaches of the Catatumbo was abandoned late in the nineteenth century under pressure of Motilon attacks after it had been occupied for about a hundred years (Jahn, 1927, p. 82). Individuals who have tried to ascend the affluents of the Río Santa Ana have met with considerable hostility above the forks of the Ríos Lora and Ariguaisa and in some instances have been forced to abandon attempts to go higher up the rivers. Even today geological survey parties pass through this country with considerable caution, although authenticated instances of deaths at the hands of the Motilones are rare. Conditions apparently are not so severe along the northern and northeastern reaches of Motilon territory, particularly in the neighborhood of Machiques.

[3] Pamplona, 1549; Salazar, 1553; Ocaña, 1570; Cúcuta, 1733; Hacari, 1780; Convención, 1829.

The basic pattern of Spanish colonization undoubtedly has much to do with the undeveloped condition of the Motilon country. Throughout this section of South America the settlers who followed the original Conquistadores tended to settle in those areas having ecological conditions similar to the Iberian Peninsula. Expansion outward into the less desirable lands was so slow that today in towns like Convención on the very doorstep of the great Catatumbo jungles there are few inhabitants who have firsthand knowledge of country no more than 50 miles away.

Nevertheless there has been a slow, continuous penetration of Motilon territory from the south and east, increasing in tempo in the past 50 years, particularly along the Río Catatumbo and its affluents. During the nineteenth century and earlier there were desultory efforts to exploit the timber, fur, hide, and other natural resources of the jungle. Today small entrepreneurs still push up the navigable streams leading westward out of Lake Maracaibo; they seldom penetrate the hill country, and since their activities are sporadic and brief the Motilones are not disturbed and the intruders are able to come and go with little actual danger.

The first true penetration of Motilon country apparently came toward the close of the nineteenth century when a cattle trail was opened to the north and west of Cúcuta. It went northwest past the present-day Colombian Petroleum Co. installations at Tibu, westward across the Catatumbo, near the so-called Riocito San Miguelito, and on to the Río de Oro following that river to its high sources crossing the Cerros Bobali at Bolan's Pass and descending to Tamalameque by way of the westward-draining streams of the Perijá slopes. From 1895 to about 1907 drovers used this trail, passing herds of cattle straight through the heart of Motilon country without undue losses. Gradually the pressure of Indian raids and ambushes forced the abandonment of the project, and the trail is used today only by the Indians. When Wilcox (1921) crossed the Perijá by way of the Cerros Bobali in 1920 he found portions of the trail still usable, and 10 or

15 years later geological parties were able to use portions of it in exploring the sandstone hills 50 miles to the southeast between the Catatumbo and Tibu Rivers.[4]

The first thoroughgoing penetration of eastern Motilon territory was the ultimate result of the discovery and exploitation of oil seeps along the southwestern rim of the Maracaibo Basin. By 1905 Virgilio Barco had set up a small plant to exploit oil seeps in the neighborhood of the modern oil camp of Petrolea, and the Colombian Government had granted the famous Barco Concession. It was found that the surface

[4] See also Febres Cordero, 1918.

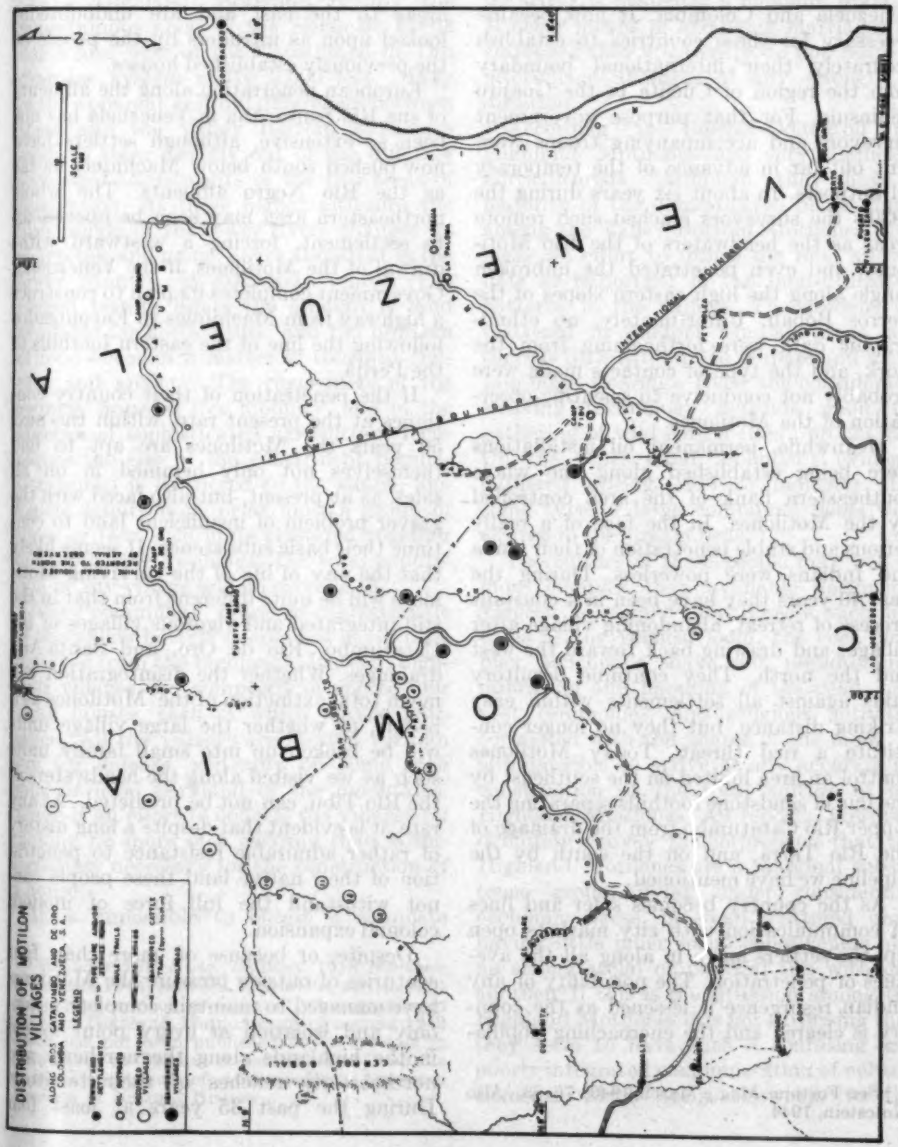

FIG. 2.—Distribution of Motilon villages.

indications represented a subsurface reserve of approximately 100,000,000 barrels of fine crude oil.[5] By the second decade of the present century a serious exploration of the oil potentials of the entire eastern Perijá foothills was under way.

Prior to this time the rather vague directives of the original treaties had served to determine the frontier of the Republics of Venezuela and Colombia. It now became necessary for these countries to establish accurately their international boundary from the region of Cúcuta to the Goajiro Peninsula. For that purpose government surveyors and accompanying troops were sent out far in advance of the temporary oil outposts. In about six years during the 1930's the surveyors reached such remote areas as the headwaters of the Río Motilones, and even penetrated the unbroken jungle along the high eastern slopes of the Cerros Bobali. Unfortunately, no ethnographic data were forthcoming from the work, and the type of contacts made were probably not conducive to scientific observation of the Motilones.

Meanwhile, permanent oil installations were being established along the whole southeastern flank of the area controlled by the Motilones. In the face of a really serious and stable penetration of their lands the Indians were powerless. During the past 40 years they have been in a constant process of retreat, abandoning village after village, and drawing back toward the west and the north. They continue desultory raids against all settlements within easy striking distance, but they no longer constitute a real threat. Today Motilones control an area limited on the southeast by the line of sandstone foothills separating the Upper Río Catatumbo from the drainage of the Río Tarra, and on the south by the pipeline we have mentioned.

As the country becomes safer and lines of communication with city markets open up, the settlers move in along all the avenues of penetration. The possibility of any Indian resurgence is lessened as the country is cleared and the encroaching population intensifies. Displaced Motilones are forced to withdraw farther and farther into territory already occupied by other Motilon villages. Of the 12 or more houses visible from the air on the Catatumbo and Río de Oro drainages it is reported that at least 6 have appeared within the past 20 years. These houses, or villages, must represent groups who lost their land in areas to the east and are undoubtedly looked upon as intruders by the people of the previously established houses.

European penetration along the affluents of the Río Santa Ana in Venezuela has not been so extensive, although settlers have now pushed south below Machiques as far as the Río Negro affluents. The whole northeastern area may soon be opened up to settlement, forcing a westward withdrawal of the Motilones, if the Venezuelan Government completes its plan to construct a highway from Machiques to Encontrados following the line of the eastern foothills of the Perijá.

If the penetration of their country continues at the present rate, within the next 50 years the Motilones are apt to find themselves not only hemmed in on all sides, as at present, but also faced with the graver problem of insufficient land to continue their basic subsistence. It seems likely that the way of life of the surviving Motilones will be quite different from that in the still integrated and vigorous villages of the Catatumbo, Río de Oro, and Santa Ana drainages. Whether the disintegration will mean total extinction of the Motilones as a people, or whether the large village units will be broken up into small family units such as we visited along the headwaters of the Río Tibu, can not be predicted. At any rate, it is evident that despite a long history of rather admirable resistance to penetration of their native land these people cannot withstand the full force of modern colonial expansion.

Despite, or because of, more than four centuries of outside pressure the Motilones have managed to maintain complete autonomy and isolation at every point except in the highlands along the northerly and northeasterly reaches of their territory. During the past 35 years at least four

[5] See Fortune Mag., March 1940: 76–83. Also Notestein, 1944.

outsiders have managed to penetrate the highland country and in some instances have established fairly peaceful contact with the Highland Motilones.[6] Since we could not visit these people the following general and necessarily incomplete summary of their culture is based on the above sources with additional personal communications from Reichel-Dolmatoff.

The Highland Motilones occupy the mountainous areas of the Sierra de Perijá north and west of the Catatumbo–de Oro drainage system above 2,000 feet. Many of the apparent cultural differences between them and the Valley Bottom Motilones seem to stem directly out of the differing ecological adjustments in the two areas of occupation. At these higher altitudes the lush jungle of the lower rivers changes its character, and game, never abundant in the lower country, is extremely scarce. The rugged terrain limits the amount of land available for horticulture, and the problem of food becomes a matter of constant concern and anxiety. The ruggedness of the country impedes free mobility, and in the absence of sophisticated agricultural techniques the size of the constituent population nuclei is restricted to the simple biological family unit, or at most a group of three or four such units clustered together in neighboring dwellings. The total population of any village seldom exceeds 15.

The "communal" house so characteristic of the valley bottom people has never been reported from the highlands. Instead, highland villages are composed of one to four small houses, each of which maybe palisaded. All the villages are located with an eye for defense, generally on some high spur or level parkland of the mountains. There is an effort to conceal the villages by making no more of a clearing than is immediately necessary for the construction of a house.

It is impossible to obtain a complete picture of Highland Motilon social organization on the basis of extant descriptions. All sources concur, however, in emphasing a basic pattern of hostility between villages which exists in spite of rules of village exogamy. One observer (Reichel-Dolmatoff, 1945, p. 69) postulates that these very rules give rise to much of the continual vendetta that is found in the hills. Raiding for wives is evidently a common practice. If other means of arranging marriages are employed they apparently do not result in intervillage alliances of any strength or duration.

According to Reichel-Dolmatoff the Highland Motilones are very inefficient horticulturists. Although they have a majority of the domesticated plants found among the Valley Bottom Motilones, they make no effort to utilize the rich, alluvial flats so important in the land-utilization patterns in the valleys. The gardens are scattered in random windfall areas, and there is little attempt to prepare and maintain large clearings. Even the considerable weaving technology depends upon the gathering of wild cotton (*ibid.*, pp. 29, 33). On the other hand, Bolinder's evidence gathered during 1914–15 indicates that some type of large communal fields were cleared in the stream beds.

The culture of these people may well be more complex than available documents suggest. Certainly they possess such features as the vertical loom, the coca complex, ponchos, a snake cult, pseudo-mummification and handling of the dead, harvest ceremonies, and religious activities correlated with the phases of the moon. It is impossible to arrive at any accurate reconstruction of the total culture of the Highland Motilones. All reports, however, definitely convey the impression that the Highland Motilones are a marginal subsistence group, living under considerable economic stress, in small scattered units having little inner social cohesiveness and no strong social or political ties with one another. If this is the situation among the Highland Motilones it is not surprising that they seem to have such a confusing and poorly integrated conglomeration of culture elements which occur elsewhere to the

[6] Bolinder, 1917 *et seq.*; de Booy, 1918; Reichel-Dolmatoff, 1945; Battista Venturello, an itinerant photographer, took a series of photographs in northern Highland Motilon country around 1942 which has not been published but is for sale in curio shops in Bogota. A partial series is on file at the Department of Anthropology, American Museum of Natural History.

northwest and the southeast in somewhat more meaningful contexts. Although they share some traits with the more technologically advanced peoples of the Caribbean littoral, we should conclude on this basis that the Highland Motilones are a peripheral variant of the Valley Bottom Motilones, a marginal enclave of a more widely spread culture pattern which prevails in the Amazon Basin.

Just as the ecological conditions of many portions of the Amazon Basin to the southeast are comparable to those in the intermontane drainage systems of the Ríos Catatumbo, de Oro, and Santa Ana, so too the basic economy and the village life of the Valley Bottom Motilones appear to approximate those of the Amazonian riverine horticulturists. The population nucleus here is a group of 40 to 80 persons living together in a permanent village, which consists of a single, large, pole-and-thatch communal house 50 to 80 feet long, with its associated fields. The typical house is located in the center of a 300-foot clearing on the top of an easily defended spur rising 50 to 100 feet above the alluvial flats at its base. Along the river bottom a mile or so from the house are three or four garden clearings, generally 300 to 400 feet in diameter. The house itself is set back from the river to give its occupants a controlling view of it for some miles in either direction, and the approaches to the house are beset with ambush points. The house clearing is a garden as well as a very effective barrier against invaders armed with bows and arrows.

The villages are spaced at intervals of about 10 miles along the courses of the rivers and their tributary creeks. The 10-mile circle thus indicated probably represents a hunting range large enough to supply the game necessary to supplement the basic food crops of the villages. Women apparently provide the mainstay of village life by horticultural work. The men are responsible for clearing, hunting, and the protection of the village from aggressors.

In an appended trait list we have listed the food crops. These are carefully tended, and the gardens show evidence of considerable labor. The defects of the slash-and-burn type of farming as practiced by tropical horticulturists are well known; fields are exhausted after no more than five or six years, and new clearings must be made in the jungle. Acquisition of steel cutting tools by the Motilones on their raids against encroaching settlers has made the task of clearing somewhat less arduous, but it still calls for a tremendous expenditure of time and labor.[7]

Conditions of life are not easy. Constructing fish weirs and traps and hunting with bow and arrow the never-abundant game—tapirs, sloths, wildcats, turkeys, bush hens, monkeys, and small rodents—must occupy a considerable portion of the men's time.

In addition, there is the ever-present problem of warfare. Motilon territory becomes progressively smaller as the Motilon settlements move inward. A constantly diminishing area of arable land and hunting territory is available. In the face of increasing outside pressure, if there were any social foundation upon which confederacies or even temporary military alliances could be made we should expect them to appear as they did under similar conditions among the Iroquois, Dakota Sioux, Sahaptins, and other groups in North America; some of whom had even less political organization upon which to base cooperative efforts. Evidence from Amazonian horticulturists and the data from Highland Motilones suggest that the primary factor preventing the development of confederacies is a basic and thoroughgoing pattern of outgroup aggression, which isolates the Valley Bottom villages one from the other.[8]

Among the constituent villages of the Valley Bottom Motilones intercourse may be further complicated by considerable linguistic diversity. The isolation of these Motilones is so complete that no zone of acculturation of any sort exists along the southern and southeastern boundaries of the Motilon territory. No outsider knows

[7] We were able to estimate the time necessary to clear a house circle and construct a house—something under two months—with steel cutting tools and probably using the labor of the entire village.

[8] An idea of the temporal depth to this picture will be given in a forthcoming paper on the archeology of the area.

a word of Valley Bottom Motilon language. We are, therefore, rather dubious of Rivet's sweeping inclusion of all Motilones in the Carib linguistic stock. In our field work we were able to make a few brief contacts with small family units of Motilones in the hill country around the headwaters of the Río Tíbu. A word list obtained from them showed a phonetic pattern unique for this part of South America. Rather garbled statements from a Motilon boy who was captured more than seven years ago when he was five years old indicate that dialectical variations exist between neighboring Valley Bottom villages in the Río de Oro region.

Warfare is an important activity among the Valley Bottom groups. Retaliation against encroaching Europeans takes place during the annual dry season hunts when complete villages move far downstream on balsa timber rafts to hunt alligator eggs before they return overland to the village sites and resume agricultural activities. Sporadic attrition raids by smaller groups plague oil installations on the eastern border of the Valley Bottom territory.

All this warfare follows a consistent pattern that not only reflects a sub-Neolithic technological level but derives out of the intense interest of the men in hunting. Men do the fighting even when women accompany war parties. Their only weapons are black palm bows and cane arrows with 3- to 4-foot-long black palm points.[9] The manufacture and possession of arrows are almost an obsession among all Motilones. Raids conducted against Motilon villages net upwards of 300 arrows and 40 or 50 bows from the "arsenal" of a single house. Motilon tactics are those employed in jungle warfare the world over: raid, ambush, attrition, avoidance of pitched hand to hand battle. Motilon raiding and ambush parties are normally small and extremely mobile, seldom numbering more than 20 individuals, often as few as 6. These groups exhibit a loose over-all coordination. The constituent groups of three to four appear free to operate in a particularistic fashion, suggesting that the kinship ties of individual or constitutent families have greater importance in the village than any control imposed by the large, extended family.

From comparative data in the surrounding areas it is safe to assume that if rules of village exogamy do exist among the Valley Bottom groups they may have little permanent effect on inter-village hostility patterns. It is doubtful that even integrative ceremonies for planting, harvest, or rites of passage operated on an intervillage level.

That the whole Motilon group should have remained relatively unchanged during the past 400 years is little short of amazing. Certainly, their attitude toward outsiders is one to discourage acculturation. Such a situation is unique enough to command the attention of modern anthropology. The problems to be studied are obvious. The whole question of cultural stability can be examined here, in particular, the ability of such technologically "poor" groups to withstand outside aggression and influences even when they are torn by severe inner conflicts. Here is an exceptional opportunity to study the functioning of a so-called primitive group as it exists without innumerable "foreign" elements. The underlying motives and processes of acculturation might well be further illuminated and in this instance it may be possible to witness the transition of a group from conditions of isolation and relative self-determination to disintegration, extinction, or new orientation. The end result for the Motilones will depend not only upon the factors at work in the present situation but upon whether modern social science can have constructive application in a situation of severe social conflict.

The severity of the Motilon "problem" from the standpoint of the encroaching groups is certainly sufficient to encourage other than punitive action on the part of the various interests involved. It is conceivable that the two Republics which govern the territory will recognize the value of assigning adequately trained resi-

[9] Reichel-Dolmatoff notes a prevalence of foreshafted iron arrows of distinctive form among the Highland Motilones. These are rare in collections from the valley bottoms, and in both areas are probably for hunting rather than war although on at least one occasion a man was hit with an arrow of this type in the Catatumbo region.

dent ethnographers to analyze the situation and make a practical application of their findings to actual field conditions. The recent investigations by the Instituto Etnológico Nacional of Colombia carried out by Reichel-Dolmatoff may be a step in this direction. More complete ethnographic studies of these Highland Motilones would be invaluable. It is, however, the crucially situated Valley Bottom Motilones who constitute the only "untouched" group and who furnish the major problem in aggression against outsiders.

Thus far the only effort made to carry out a consistent and scientific study of the Valley Bottom Motilones has been made possible through the cooperation of a private North American concern. The Colombian Petroleum Co., in sponsoring the American Museum of Natural History's expedition, showed unusual foresight and set a precedent for a manner in which these problems may be approached to avoid a repetition of the tragic failure of the "Indian policy" pursued by the United States up to a fairly recent period.

Although the results of the Museum's expedition were fundamentally negative from a classical ethnographic point of view, they did suggest the possibility of making contact with these people along the lines followed by Curt Nimuendaju with the Parantintin of Brazil (Baldus, 1946). It is hoped that applied anthropology has now advanced far enough to command the authority necessary to prevent aggressions by the encroaching groups if "peace" could be established with the Motilones. Otherwise there might well be a repetition of the Parantintin tragedy.

The primary difficulty in any program of making contact with the Valley Bottom Motilones is, of course, that there is no "trade language" in the Motilon area. Furthermore the language of the Valley Bottom Motilones is unrecorded and unknown. The language of the Highland Motilones may prove to be intelligible to the Valley Bottom groups. Once an opening of this sort is found, the way can be open for a scientific study of some 1,000 to 1,500 completely untouched American aborigines.

SELECTED LIST OF CULTURE ELEMENTS FOUND AMONG THE MOTILONES

x Presence demonstrated.
– Absence demonstrated.
(?) Presence probable, but not demonstrated.
? Presence doubtful.

	Valley Bottom	*Highland*
Platform beds	x (Catatumbo)	x
Hammocks	x (Río de Oro)	–
Suspension bridges	x (Río de Oro)	–
Communal dwellings	x	–
Large communal fields	x	(?)
Balsa timber rafts	x	–
Fish weirs (stone and leaf)	x	x
Grinding stones	x	x
Face and body painting	(?)	x
Digging stick	x	x
Gourd containers	x	x
Tiger tooth beads (men)	x	– (except Upper Tiba)
Seed beads (women)	–	x
Chicha	x	x
Famine cannibalism	?	x
Snake cult	x (Río de Oro)	x
Handling and reburial of dead	(?)	x
Vertical loom	(?)	x
Spindle whorl and ring suspension for spinning	(?)	x
Poncho (men)	–	x
Cape (women)	–	x
Pubic apron (men)	x	–
Pubic apron (women)	x	x
Latticework basketry	x	x
Mats	x	x
Wicker fish trap	(?)	x
Woven fire fan	–	x
Feather fire fan	(?)	x (Upper Tiba)
Woven headbands	x	x
Thread cross	(?)	x
Cats cradle	(?)	x
Ritual bullroarer	(?)	x
Double end stickcomb	(?)	x
Bast and agave cordage	x	x
Bamboo quivers	x	–
Wooden quivers	x	x
Miniature bird arrows	–	x
Blunt bird arrows	x	–
"Harpoon" arrows	x	x
Elaborate arrow bindings	–	x
Palm wood points	x	x
Iron triangular points	x	x
Arrows unfeathered	x	x
Unsprung bow	x	x
Musical bow	(?)	x
"Ax" flute	(?)	x
Pan-pipes	(?)	x
Tubular flute	(?)	x
Pottery vessels	x	x
Tobacco pipes	(?)	x
Tobacco	x	x
Cotton	x	x
Potatoes	(?)	x
Corn	(?)	x
Sweet manioc	x	x
Bananas and plantains	x	x
Beans	(?)	x
Sugarcane	x	x
Pineapple	x	x
Papaya	x	x
Peppers	x	x

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BOTANY.—*Studies in* Lonchocarpus *and related genera, I: A Synopsis of* Willardia.[1]

FREDERICK J. HERMANN, U. S. Department of Agriculture.

The relationship of the leguminous genus *Willardia*, of the tribe Galegeae, characterized by the possession of dehiscent pods, with *Lonchocarpus*, of the tribe Dalbergieae, which have indehiscent fruits, would not appear to be very close. The resemblance of the two groups is so great, however, particularly in the flowering or in the merely vegetative condition, that an observer as astute as Bentham (*1*) erroneously referred to *Lonchocarpus* two species which, when subsequently collected in the fruiting stage, proved to belong to *Willardia*; and no less than five additional arborescent legumes from Mexico and Central America described by other authors as Lonchocarpi now appear to be logically assigned to *Willardia*. A brief synopsis of *Willardia*, heretofore supposed to comprise but three species, may consequently be useful.

The genus *Willardia* was established by J. N. Rose (*2*) in 1891, its basis being Sereno Watson's *Coursetia mexicana*, which had been described from fruiting material alone. Rose pointed out that additional specimens in flower showed the plant to be

[1] Received June 17, 1947.

amply distinct from *Coursetia* in its "truncate" calyx and glabrous style. In 1905 Rose (*3*) added a second species to the genus, *Willardia parviflora*. Standley (*4*), in his *Trees and shrubs of Mexico* (1922), transferred Bentham's *Lonchocarpus eriophyllus* to *Willardia* and provided a key to the three species of the genus then known. The most recent account of the group appeared in North American Flora in 1924, wherein Rydberg (*5*) presented a comprehensive treatment of the three species.

In current studies of the Mexican and central American material of *Lonchocarpus* from the U. S. National Herbarium and the Chicago Natural History Museum by the writer it was noted that an excellent series of collections by Hinton of *Lonchocarpus obovatus* Benth. included several specimens bearing pods that had a decidedly unconventional aspect for *Lonchocarpus*. In contrast with fruits characteristic of this genus, highly variable though they are, these pods were almost marginless with the epidermis conspicuously marked by elongated resin ducts. Both of these features are possessed by the legumes of *Willardia*, and closer inspection revealed the fact that several of the oldest pods showed the beginning of dehiscence. From comparison of the floral and vegetative morphology with that of the latter genus the Hinton collections were found to fall well within its limits, while their comparison with a fragment (consisting of a flower and a leaflet) of the type in the U. S. National Herbarium and with a photograph of the complete type specimen of *Lonchocarpus obovatus* showed them to be an excellent match with it.

The tardily dehiscent pods of species of *Willardia* leads to their frequent confusion, even during most of the fruiting stage, with *Lonchocarpus*. A second instance of such misidentification appears in the case of Harms's *Lonchocarpus argyrotrichus*. Collections by Hinton again proved to be the solution here. His flowering specimen, *8059* (distributed as *Willardia eriophylla*), agrees in all essential points with the type collection of *Lonchocarpus argyrotrichus*, but mature pods collected seven months earlier from the same plant are plainly dehiscent.

Such differences as could be found between *Lonchocarpus lindsayi* Standl., recently described from Panama, and *L. calderoni* Standl., of El Salvador, appear to be wholly quantitative, so that *L. lindsayi* seems better regarded as a geographic variety of the latter. *L. calderoni*, however, is apparently identical with *L. salvinii* Harms, described from Guatemala, which, in turn, differs in no essential character from the Mexican *Robinia schiedeana* Schlecht. Schlechtendal's species was transferred to *Lonchocarpus* by Harms at the same time that he proposed *L. salvinii*, from which he believed it differed "*durch etwas kleinere Kelche und zartere meist einblütige, selten zweiblütige Pedunculi.*" Measurements of a large series of calyces, however, fail to substantiate any difference in size, and the slenderer, mostly 1-flowered, seldom 2-flowered, peduncles of the type of *Robinia schiedeana* are to be ascribed to the greater maturity of the specimen: fruiting material of *L. salvinii* displays conspicuously elongated peduncles upon which more than one pod is only rarely developed. In none of the material described under the above names are the wing petals adherent to the keel, as they are in *Lonchocarpus*: the distinctly cyathiform calcyces would be another anomaly in that genus; and although the fruiting specimens do not have pods old enough for dehiscence to have begun, they are characteristically those of *Willardia*, the resin ducts being quite conspicuous.

The transfer to *Willardia* of the three species considered to be distinct in the above discussion results in doubling the number of species so far known in this genus.

TAXONOMIC TREATMENT

Willardia Rose, Contr. U. S. Nat. Herb. 1: 97. 1891. Type species: *Coursetia mexicana* S. Wats.

KEY

Corolla 6–15 mm long, glabrous or glabrate; mature leaflets glabrous to sparsely pilose; pods glabrous to puberulent or sericeous.
Pods narrow (9–12 mm wide), the margins plainly thickened.
Corolla 6–7 mm long; leaflets 11–21, very small (8–16 mm long); pods glabrous .....1. *W. parviflora*

Corolla 10–15 mm long (in *W. schiedeana* var. *lindsayi* 8.5–9.5 mm); leaflets 5–12 (15), larger, 20–45 mm long (sometimes only 10 mm in *W. schiedeana* var. *lindsayi*); pods glabrous to silky-strigose.
Pods glabrous, abruptly contracted into a stipe; corolla 8.5–11 mm long.....2. *W. schiedeana*
Pods sericeous, long-tapering at the base; corolla 12–15 mm long.3. *W. mexicana*
Pods broader (13–18 mm wide), the margins scarcely evident.....4. *W. obovata*
Corolla 20–23 mm long, at least the banner densely pubescent; mature leaflets silky-strigose to velutinous; pods velutinous.
Leaflets 11–23, relatively small (15–35 by 8–10 mm); pubescence of calyx and corolla tomentose to velutinous; pods 9–13 by 1.3 cm, thin, velutinous.....5. *W. eriophylla*
Leaflets 7–9, larger (30–75 by 15–30 mm); pubescence of calyx and corolla sericeous; pods 8–13.5 by 1.7–2.3 cm., thick and rigid, densely velutinous to lanate.....6. *W. argyrotricha*

1. **Willardia parviflora** Rose, Contr. U. S. Nat. Herb. **8**: 313. 1905.

Type locality: Yautepec, State of Morelos, Mexico, *Pringle 8470*.

Distribution: Lava fields and dry, sunny fields, Yautepec, and between Cuernavaca and Alpuyeca, Morelos.

Representatives: *I. K. Langman 3516*; *Pringle 8470, 11347; Rose & Painter 6576*.

2. **Willardia schiedeana** (Harms) Hermann, comb. nov. *Robinia schiedeana* Schlecht., Linnaea **12**: 306. 1838. *Lonchocarpus schiedeanus* Harms, Fedde Rep. Spec. Nov. **17**: 324. 1921. *Lonchocarpus salvinii* Harms, l.c. 323 (type: Volcán de Fuego, Guatemala, *Salvin* in 1873–74). *Lonchocarpus calderoni* Standl., Journ. Washington Acad. Sci. **15**: 476. 1925 (type: Cerro de Guayabal, El Salvador, *S. Calderón 22022*).

Type locality: Between Veracruz and Santa Fé, Mexico *Schiede 621* (Field Mus. photo no. 18406).

Distribution: Forests and clearings, State of Veracruz, Mexico, Guatemala and El Salvador.

Representatives: *Calderón 1979, 2022; Salvin* in 1873–74; *Standley 58059, 64752, 64872*.

2a. **Willardia schiedeana** var. **lindsayi** (Standl.) Hermann, comb. nov. *Lonchocarpus lindsayi* Standl., Field Mus. Publ. Bot. **17** (2): 195. 1937.

Type locality: Bejuco, Canal Zone, Panama, *W. L. Lindsay 446*.

Distribution: Known only from the type locality.

Representatives: *W. L. Lindsay 399, 446*.

Differs from the typical form in its smaller leaflets (10–25 by 7–13 mm), slightly smaller corolla (8.5–9.5, rather than 10–11, mm long), and particularly in its short pods (3–5.5, rather than 5.5–8, cm in length).

3. **Willardia mexicana** (S. Wats.) Rose, Contr. U. S. Nat. Herb. **1**: 98. 1891. *Coursetia* (?) *mexicana* S. Wats., Proc. Amer. Acad. **21**: 424. 1886.

Type locality: Hacienda San Miguel, Chihuahua, Mexico, *E. Palmer "C"*.

Distribution: Forested slopes, southeastern Chihuahua, Sonora and Sinaloa, Mexico.

Representatives: *Gentry 1446, 2205; Ortega 4556, 5217, 5502; Palmer "C", 332, 717*.

4. **Willardia obovata** (Benth.) Hermann, comb. nov. *Lonchocarpus obovatus* Benth., Journ. Linn. Soc. **4**: Suppl. 92. 1860.

Type locality: Chilla, Puebla, Mexico, *Andrieux* 440.

Distribution: Dry hills, barrancas, and llanos States of Michoacán and Mexico to Puebla and Guerrero, Mexico.

Representatives: *Andrieux 440; Hinton 3742, 5523, 5937, 5942, 5946, 6290, 6958, 6959, 7041*.

The leaflets in this species (5 to 9 in number) are extremely variable in outline and vesture. Ranging from 1.6–4.5 cm by 0.9–2.5 cm in size, they are commonly ovate-elliptic with tapering base and obtuse apex, but in *Hinton 6290*, for example, they are predominately orbicular-ovate to broadly ovate (the terminal generally obovate) with emarginate apices, whereas in *Hinton 6959* they are elliptic to oblanceolate with acute apices. These variations do not appear to be correlated with the season, as does the vesture. Very young leaflets are usually densely sericeous, especially beneath, but at maturity they become completely glabrous. The pods (6–15 cm by 1.3–1.8 cm) are elliptic to oblong, long-tapering at both ends, thin, very flat, and at first finely appressed-sericeous with a marked silvery sheen but becoming glabrate and tawny-brown.

5. **Willardia eriophylla** (Benth.) Standl., Contr. U. S. Nat. Herb. **23**: 483. 1922. *Loncho-*

carpus eriophyllus Benth., Journ. Linn. Soc. **4**: Suppl. 94. 1860.

Type locality: Chilla, State of Puebla, Mexico, *Andrieux 439*.

Distribution: Lava fields and rocky gulches, States of Puebla, Morelos, and Guerrero, Mexico.

Representatives: *Langlassé 236; Pringle 8987, 11348.*

6. **Willardia argyrotricha** (Harms) Hermann, comb. nov. *Lonchocarpus argyrotrichus* Harms, Fedde Rep. Spec. Nov. **17**: 320. 1921.

Type locality: Near Tlaxmalac, District of Hidalgo, State of Guerrero, Mexico, *Seler 4276*

Distribution: Hills, States of Mexico and Guerrero, Mexico.

Representatives: *Hinton 7085, 8059; E. W. Nelson 2043; Seler 4276.*

In addition to the characters given in the foregoing key for the hitherto undescribed pods. represented in *Hinton 7085*, it may be mentioned that they are approximately oblong in outline, thick-margined, especially the vexillar suture, deep tan in color, and 1–3-seeded (seed 13 by 9 mm, semilunate, dark mahogany-red). The blades of the leaflets, borne on petiolules 6–8 mm long, are strigose above and somewhat appressed-pilose beneath; in *Hinton 7085* (in fruit) they are oblanceolate, tapering at the base, with an abruptly acuminate apex (45–63 mm by 18–22 mm), whereas in *Hinton 8059* (same tree in flower) they are oval-elliptic, rounded at the base, and obtuse at the apex (75 by 30 mm).

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ENTOMOLOGY.—*A new species of* Pristoceuthophilus *from Oregon, and remarks on certain special glands of Orthoptera (Gryllacrididae; Rhaphidophorinae).*[1]

Ashley B. Gurney, *U. S. Bureau of Entomology and Plant Quarantine.*
(Communicated by R. E. Blackwelder.)

The genus *Pristoceuthophilus* occurs in Mexico and the western parts of the United States and Canada. The species superficially resemble those of the well-known genus *Ceuthophilus* but differ conspicuously in that males of most species bear large spines, tubercles, or other distinctive structures on the dorsum of the abdomen. There are additional differences between the two genera, such as the crenulations of the ovipositor of *Pristoceuthophilus*, rather than distinct teeth which rarely are absent in *Ceuthophilus*, and the absence in *Ceuthophilus* of a basal, ventral, sensory seta on each tarsal claw. My friend Borys Malkin, of the University of Oregon, has recently sent to the National Museum specimens of a new species of *Pristoceuthophilus*, which has the dorsum of the male abdomen specialized in a very ornate and remarkable manner. The only previously described species which approaches the new one in dorsal specialization is *gaigei* Hubbell, 1925, described from the Olympic Mountains, Mason County, Wash. Although there is no definite information concerning the benefits which these insects may derive from the specialized abdominal structures, glandular activity may be involved, and a discussion of such functions in related Orthoptera is included to point out the nature of this possibility.

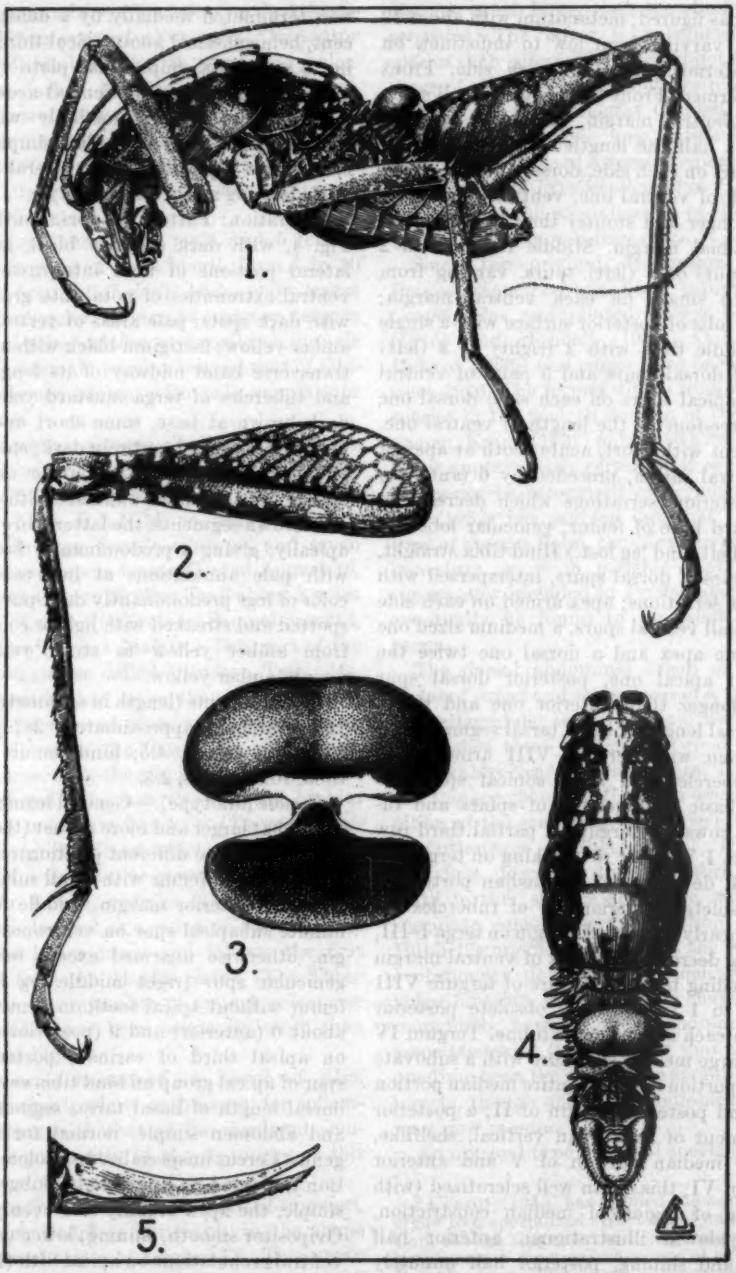
My appreciation is extended to Mr. Malkin for making this interesting species available for study; also to my colleague Arthur D. Cushman, for preparing the illustrations.

Pristoceuthophilus sargentae, n. sp.

Figs. 1–5

Male (holotype).—General size about average for genus. Head with fastigium extending in front of eyes, moderately less elongate and acute than in *celatus* (Sc.). Antenna delicate, slender, with about 130 segments (plus a few lost apical ones).

[1] Received May 22, 1947.



FIGS. 1–5.—*Pristoceuthophilus sargentae*, n. sp.: 1, Holotype, lateral view (left hind leg missing); 2, same, externolateral view of right hind leg; 3, same, posterior view of Hubbell's organ; 4, same, dorsal view (legs and antennae not shown); 5, allotype, lateral view of ovipositor. (Drawings by Arthur D. Cushman.)

Thorax as figured; metanotum with about 12 tubercles, varying from low to indistinct, on ventroposterior portion of each side. Front femur unarmed. Front tibia with 3 small spurs on each ventral margin, distal one scarcely more than half the length of 2 basal ones; 2 apical spurs on each side, dorsal one two-thirds the length of ventral one, ventral apical spur slightly longer and stouter than basal spur of ventral tibial margin. Middle femur with 2 (right femur) or 3 (left) spurs, varying from minute to small, on each ventral margin; genicular lobe of posterior surface with a single spur. Middle tibia with 2 (right) or 3 (left) staggered dorsal spurs and 3 pairs of ventral spurs; 2 apical spurs on each side, dorsal one about three-fourths the length of ventral one. Hind femur with short, acute tooth at apex of each ventral carina, preceded by 6 (anterior) or 9 (posterior) serrations which decrease in size toward base of femur; genicular lobe unarmed. (Left hind leg lost.) Hind tibia straight, with 5 pairs of dorsal spurs, interspersed with numerous serrations; apex armed on each side with 2 small ventral spurs, a medium sized one at extreme apex and a dorsal one twice the length of apical one, posterior dorsal spur slightly longer than anterior one and three-fifths dorsal length of basal tarsal segment.

Abdomen with terga I–VIII armed with blunt tubercles and long, conical spines as figured; basic arrangement of spines and tubercles 2 rows per tergum, a partial third row on tergum I, anterior row lacking on terga VII and VIII, development on median portion of terga obsolete; posterior row of tubercles developed nearly to ventral margin on terga I–III, extending decreasingly short of ventral margin on succeeding terga; armature of tergum VIII reduced to 1 small and 2 obsolete posterior tubercles each side of median line. Tergum IV bears a large median structure with a subovate anterior portion covering entire median portion of III and posterior margin of II; a posterior development of this organ vertical, shelflike, covering median portion of V and anterior margin of VI; this organ well sclerotized (with exception of region of median constriction, shown pale in illustrations), anterior half smooth and shining, posterior half minutely roughened, traces of what may be secretory pores at point of maximum constriction. Cercus with basal two-thirds unsegmented, this portion terminated medially by a densely pubescent, hemispherical knob, apical third comprising 5 segments. Supra-anal plate triangular, longitudinally grooved. Ventral aedeagal lobe membranous, covered medially with short, stout spinules. Subgenital plate simple, broadly emarginate apically, each lateral posterior angle bearing a short, simple style.

Coloration: Pattern of dorsal surface as in Fig. 4, with dark areas of black grading on lateral portions of nota into russet and, at ventral extremities of nota, into gray mottled with dark spots; pale areas of vertex and nota amber yellow; fastigium black with a pale gray transverse band midway of its length; spines and tubercles of terga mustard yellow, a few dark brown at base, some short ones, particularly on tergum I, entirely dark; special organ of IV cinnamon-buff; antennae ochraceous-orange in basal third, annulate with occasional pale brown segments, the latter more numerous apically, giving a predominantly brown color, with pale annulations at intervals. Ground color of legs predominantly dark purplish gray, spotted and streaked with lighter color varying from amber yellow to straw yellow; tarsi mainly amber yellow.

Measurements (length in millimeters): Body, 11.5; antenna, approximately 28; pronotum, 3.3; front femur, 4.5; hind femur, 9.4; hind tibia, 10.5; cercus, 2.8.

Female (allotype).—General form as in male; somewhat larger and more robust (though body is shorter due to different position); differing as follows: Front femur with small subapical spur on ventroanterior margin; middle femur with minute subapical spur on ventroposterior margin, otherwise unarmed except for posterior genicular spur (right middle leg lost); hind femur without apical teeth on ventral carinae, about 6 (anterior) and 9 (posterior) serrations on apical third of carinae; posterior dorsal spur of apical group on hind tibia seven-eighths dorsal length of basal tarsal segment. Thorax and abdomen simple, normal for females of genus. Cercus unspecialized, obsolete segmentation indicated on apical half. Subgenital plate simple, the apex broadly and evenly rounded. Ovipositor smooth, shining; lower valve with 9 ventral crenulations on apical fifth (Fig. 5).

Coloration: Nota with a median, longitudinal pencil stripe of ivory yellow; pale areas not confluent as in male, consisting of general

sprinkling of amber-yellow spots on dark background. Terga spotted as on nota. Ovipositor empire yellow, basal fourth somewhat paler. Antennae darker than in male. Coloration otherwise essentially as in male.

Measurements (length in millimeters): Body, 11.0; pronotum, 3.6; front femur, 4.9; hind femur, 10.0; hind tibia, 11.6; cercus, 3.0; ovipositor, 6.0.

Nymphs.—There are 2 male and 5 female nymphs, varying in body length from 7 to 10 mm (hind femur, 6–7 mm). Males show traces of dorsal tubercles, no sign of organ on tergum IV. Dorsal color pattern essentially as in male type, in one female varying toward that of allotype. Antennae brown, with pale annulations at intervals.

Type locality.—Oregon Skyline Trail, Three Sisters Primitive Area, Lane County, Oreg. (elevation 5,700–6,000 feet).

Type.—Male, U.S.N.M. no. 58319.

The male type, female allotype, and seven immature specimens were collected August 18, 1946, on the Oregon Skyline Trail about 3 miles from Frog Camp. (Collectors: Samuel Sargent, Mrs. Sargent, Borys Malkin.) This part of the trail is sometimes called Obsidian Trail. Mr. Malkin writes that more than 20 specimens were seen, scattered from 1 to 6 feet above ground, all under the loose bark of a single standing tree. Only the specimens here reported were captured. The tree was believed by him to be the mountain hemlock (*Tsuga mertensiana* (Bong) Sarg.), of which there is a large stand in the vicinity, or possibly the silver (or lovely) fir (*Abies amabilis* (Dougl.) Forbes). The tree is located at a point on the trail just before the latter turns and follows the first lava flow from the Middle Sister. (The Three Sisters are the remnants of extinct volcanoes, each said to have been originally more than 10,000 feet high.)

The species is named in honor of Mrs. Samuel Sargent, whose enthusiasm for collecting, together with that of her husband, contributed significantly to the discovery of this unusual camel-cricket.

This species is most closely related to *gaigei*, from which it differs noticeably in the shape of the dorsal organ of tergum IV. This organ in *gaigei* does not overlap III anteriorly, and only slightly over V posteriorly. The median posterior spines of terga V–VII of *gaigei* are distinct, much larger than the obsolete ones of *sargentae*. The latter is a somewhat larger species than *gaigei*. The cerci do not differ from those of *cercalis* Caudell but are more slender than those of *tuberculatus* Caudell. With the exception of *gaigei* and *tuberculatus*, the straight hind tibia of *sargentae* separates it from most species of *Pristoceuthophilus*. *P. tuberculatus* differs in the specialization of the terga, as well as in the more robust cerci.

Since the original description in 1903, *Pristoceuthophilus* has been compared with *Ceuthophilus* and related genera by Caudell (1916) and Hubbell (1936). Only *arizonae* Hebard (1935) and *gaigei* have been described since 1916. The former differs from most other species in the smooth dorsum of the male abdomen. Karny (1937) published a list of species, but it appears fairly certain that several of the 11 species he recognized are synonyms. Hubbell (1932) has pointed out that the unique type of *rhoadsi* Rehn, the Mexican genotype, is immature, so it is possible that the other species now included in *Pristoceuthophilus* will eventually be found to represent a distinct genus.

The dorsal abdominal organ of the adult males of *gaigei* and *sargentae* is of a type unique in gryllacridids, so far as I am aware, and it establishes these species as two of the truly remarkable Nearctic Orthoptera. I propose to call this special organ *Hubbell's organ*[2] in recognition of the searching, comprehensive studies on Orthoptera conducted by T. H. Hubbell, who first described this structure in *gaigei*. Until further studies are made, we can only speculate concerning the function, if any, of Hubbell's organ. Perhaps it is the result of an evolutionary development which did not involve function, merely bizarre shape. It seems more likely, however, that glandular activity is associated with the organ, or that such has at one time been the case in the evolution of these insects, though only the functionless structure may now remain.

An unusual type of tergal specialization was

[2] Uvarov (1943) has applied the name *Krauss's organ* to a specialized structure of unknown function, though suspected of being sensory, found in both sexes of most grasshoppers of the subfamily Pamphaginae. The organ consists of a shallow chamber, covered by a sclerotized plate bearing tubercles or ridges, located on each side of the body in the ventro-anterior part of tergum II.

described by Hebard (1939) in *Salishella mirabilis*, a then new genus and species of Rhaphidophorinae from Pierce, Idaho. The male has two conspicuous transverse ridges on each of the basal 7 terga, one ridge median, the other at the posterior margin. It is barely possible that the origin of these ridges is akin to that of the specialization of *Pristoceuthophilus*, though the appearance of the two genera is quite different. Because of the likelihood that function may be associated with Hubbell's organ, the following information on the specialized physiology of certain Orthoptera is given with the hope that it will stimulate future students to make anatomical or life-history studies of *Pristoceuthophilus*.

NOTES ON THE SPECIAL GLANDS OF CERTAIN ORTHOPTERA

With the possible exception of mantids, all major families of Orthoptera contain certain species that possess specialized glands, usually on the thorax or abdomen, which serve either to attract the female at time of mating or to protect the insect from enemies by virtue of repugnatorial qualities. Among the best-known examples are the metanotal glands (glands of Hancock) of *Oecanthus* males (tree crickets) and the tergal glands of *Blattella* males (German cockroach and relatives), which attract females, and the prothoracic glands of *Anisomorpha* which enable this large walkingstick to eject a milky fluid that is extremely painful to the human eye (see Stewart, 1937, Maynard, 1889). A good general treatment of these glands, as found in Orthoptera, is that of Chopard (1938), who includes references to the more important of the fairly numerous papers dealing with special glands of Gryllacrididae and Tettigoniidae, as well as those of other families. Packard (1898) has discussed defensive glands of insects as a whole.

Males of at least two genera of Gryllacrididae (*Troglophilus*, *Hadenoecus*) have glands, ordinarily concealed beneath the body wall, which occasionally are everted and extruded between certain of the terga. In other genera (*Dolichopoda*, *Tachycines*) glands have been reported which are located in the region of intersegmental membranes of the terga and are attractive to females, though extrusion may not occur. Hancock (1905) reported an eversible gland which he found protruded between terga III and IV of the male of *Oecanthus*.

Seven or more genera of Tettigoniidae emit fluid from special openings in the body wall or from intersegmental membranes of the body or legs. Frequently the fluid is merely the blood of the insect, but in other cases glands secrete special fluids, though in either type defense appears to be the primary function in the majority of species. An example of what may be a combination of defense and sexual attraction is furnished by *Bradyporus multituberculatus* Fisch.-Waldh., a clumsy inhabitant of the uncultivated Russian steppes which somewhat resembles the Mormon cricket, *Anabrus*, in general habitus. Boldyrev (1928) has studied this species in detail. In both sexes there are slits borne on raised longitudinal ridges on the pronotum, metanotum and terga I-IX. Blood from within the body is ejected from these slits, sometimes to a distance of about 5 inches, but the ejection is definitely associated with the application of pressure to the sides of the body. This occurs when the insect is seized, and from males when females climb upon them during mating. While mating, the female often bites pieces from the hind margin of the pronotum, and, as the pressure starts the flow of blood, drinks it greedily.

The male of a Palearctic phaneropterine katydid, *Isophya acuminata* Brunn., has a specialized heart-shaped area in the middle of tergum I which bears short glandular hairs arranged in two broad longitudinal rows. The remaining surface of the tergum is smooth. Engelhardt (1915) has described the histology of this organ, which he believes is comparable to the metanotal glands of male *Oecanthus*, though of a much simpler structure. He says the female of *acuminata* applies her mouth to the glandular hairs during mating. The hairs are associated with secretory cells located in the body wall. There is no special reservoir for the fluid, which simply gathers among the hairs when glandular activity is stimulated.

So far as I know, no New World tettigoniid has been shown to have special glands or adaptations for emitting fluid

either as a means of defense or an attraction for the opposite sex. The products of secondary sexual glands in the perianal region or those of regurgitation are in another category.

It is the habit of many female Orthoptera to eat the spermatophore after it has been attached to her body by the male. Boldyrev (1914) has stressed the importance of protecting the spermatophore of Gryllidae and Tettigoniidae after mating until the spermatozoa have passed into the female's body. Substances produced by the male which are attractive to the female frequently serve to prevent her from consuming the spermatophore quickly. It is probable that in the long course of evolution an important impetus toward the successful development and survival of certain species has been supplied by the functions of the specialized male glands discussed in the foregoing paragraphs.

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ZOOLOGY.—*The southernmost* Natrix.[1]

RODGERS D. HAMILTON, University of Michigan. (Communicated by HERBERT FRIEDMANN.)

Dr. L. C. Stuart recently turned over to me for study two snakes of the genus *Natrix* from the U. S. National Museum collection, bearing the following data—Tenedores, Guatemala, Dr. Newton Miller, 1905. As this locality, if valid, would constitute the southernmost record on the continent for the genus, and as it is not far away from Dr. Hobart M. Smith's Mexican record (Proc. U. S. Nat. Mus. :93: 454. 1943) for *Natrix rhombifera rhombifera* from Emiliano Zapata, Tabasco, these snakes were examined carefully. Their distinctness from *rhombifera* was immediately apparent. Closer study reveals that they are probably intergrades between *Natrix sipedon sipedon* and *N. s. pleuralis*. Scale counts are as follows:

U.S.N.M. no.	*Dorsals*	*Ventrals*	*Caudals*
48963	23-23-17	140	tail broken
48964	23-25-19	138	73

The belly of no. 48963 has semilunar blotches, these becoming darker and breaking into speckles posteriorly. No. 48964 is spotted and speckled below, increasingly so posteriorly. Both snakes have 26 cross bands on the body. They thus seem to fall within the category of Mississippi Valley intergrades of *sipedon* and *pleuralis* as described by Clay (Copeia 1938: 173–182).

The possibilities are two. These snakes either were carried somehow to Guatemala and established themselves there, or some mishap has occurred in handling and labeling. Dr. Miller's reptiles were collected incidentally, while he was engaged in taking fishes, and the specimens were sent first to the University of Indiana and from there transshipped to the National Museum. The University, at Bloomington, Ind., is in the intergrading area of *N. s. sipedon* and *N. s. pleuralis* (Minton, Amer. Midl. Nat. 32: 438–477. 1944), and might be expected to have had specimens of this type in its collections. It seems very likely, therefore, that some sort of accident occurred at the University, resulting in the inclusion of these snakes in the National Museum shipment, and that this accounts for the otherwise astonishing occurrence of this animal so far south of its hitherto known range. Although it is not improbable that *Natrix* will be found in Guatemala, I believe that these snakes must be withheld from the faunal list of that country and that when and if *Natrix* is found to occur there it will not be of this species. Dr. Hobart Smith's record therefore remains as the southernmost record for the genus on this continent.

[1] Received August 7, 1947.

PROCEEDINGS OF THE ACADEMY

49TH ANNUAL MEETING

The 49th annual meeting of the Academy, held in the Auditorium of the Cosmos Club, January 16, 1947, after the 346th meeting of the Academy, was called to order at 9:45 P.M. by the President, HUGH L. DRYDEN, with 32 persons in attendance.

The minutes of the 48th annual meeting were approved as published in the JOURNAL 36: 170–176. 1946.

The reports of several officers and of the Committees of Auditors and Tellers were read and accepted. These reports are recorded at the end of the minutes.

After the acceptance of the report of the Committee of Tellers, the President declared the following duly elected to the given offices.

WALDO L. SCHMITT, *President*,
C. LEWIS GAZIN, *Secretary*,
HOWARD S. RAPPLEYE, *Treasurer*,
WILLIAM W. DIEHL and F. G. BRICKWEDDE, *Board of Managers to January 1950*.

The Secretary presented for the Affiliated Societies their nominations for Vice-Presidents of the Academy as follows:

Philosophical Society of Washington—FRED L. MOHLER
Anthropological Society of Washington—FRANK M. SETZLER

Biological Society of Washington—JOSEPH S. WADE
Chemical Society of Washington—IRL C. SCHOONOVER
Entomological Society of Washington—CARL F. W. MUESEBECK
National Geographic Society—ALEXANDER WETMORE
Geological Society of Washington—WILLIAM W. RUBEY
Medical Society of the District of Columbia—FREDERICK O. COE
Columbia Historical Society—GILBERT GROSVENOR
Botanical Society of Washington—L. EDWIN YOCUM
Washington Section of the Society of American Foresters—WILLIAM A. DAYTON
Washington Society of Engineers—CLIFFORD A. BETTS
Washington Section of the American Institute of Electrical Engineers—FRANCIS B. SILSBEE
Washington Section of the American Society of Mechanical Engineers—MARTIN A. MASON
Helminthological Society of Washington—AUREL O. FOSTER
Washington Branch of the Society of American Bacteriologists—CHESTER W. EMMONS
Washington Post of the Society of American Military Engineers—CLEMENT L. GARNER
Washington Section of the Institute of Radio Engineers—HERBERT GROVE DORSEY
Washington Section of the American Society of Civil Engineers—OWEN B. FRENCH

The Secretary was instructed by the members present to cast a unanimous ballot for these nominees.

The President, HUGH L. DRYDEN, announced the recipients of the Academy's Awards for Scientific Achievement for 1946 as follows:

In the Biological Sciences, WALDO RUDOLPH WEDEL, United States National Museum, in recognition of his distinguished service in contributing to the knowledge of the prehistory of human ecology in the central Great Plains.

In the Engineering Sciences, MARTIN ALEXANDER MASON, Beach Erosion Board, in recognition of his distinguished service in erosion studies leading to successful beach invasions by allied armed forces during the war.

In the Physical Sciences, GEORGE WASHINGTON IRVING, JR., Bureau of Agricultural and Industrial Chemistry, in recognition of his distinguished service in biochemistry and especially for work on antibiotics in tomato plants.

The Retiring President, HUGH L. DRYDEN, appointed Past Presidents HARVEY L. CURTIS and JOHN E. GRAF to escort the incoming President, WALDO L. SCHMITT, to the chair. Dr. SCHMITT adjourned the meeting at 10:30 P.M.

The following reports were presented at the meeting:

REPORT OF THE SECRETARY

During the Academy year, January 18, 1946, to January 16, 1947, 36 persons were elected to membership, 29 resident and 7 nonresident. Of these, 11 resident and 1 nonresident qualified for membership, and 6 resident accepted membership but have not yet qualified by payment of dues. Seventeen persons, 11 resident and 6 nonresident, elected to membership on January 13, 1947, have not yet been notified of their election. Eight resident members and one nonresident member elected to membership in the preceding Academy year qualified during the present Academy year just ending. The new members who qualified in the Academy year 1946 were distributed among the various sciences as follows: 6 in botany, 4 each in chemistry and physics, 2 each in anthropology and entomology, and 1 each in geology, mathematics, and medicine.

Six resident and 5 nonresident members, having retired from the remunerative practice of their professions, were placed on the retired list of members to enjoy all the privileges of active membership without further payment of dues. Two resident and two nonresident members resigned in good standing. One nonresident member was dropped for nonpayment of dues.

The deaths of the following members were reported to the Secretary:

FRANK LEECH, Washington, D. C., in February 1942.
CHARLES W. DABNEY, Cincinnati, Ohio, on June 15, 1945.
GLENN L. PARKER, Washington, D. C., on February 12, 1946.
ALBERT C. HUNTER, Washington, D. C., on April 13, 1946.
GIFFORD PINCHOT, Milford, Pa., on October 4, 1946.
GERALD F. LOUGHLIN, Washington, D. C., on October 22, 1946.

Mr. PINCHOT was the last surviving patron of the Academy.

On January 16, 1947, the status of membership was as follows:

	Regular	Retired	Honorary	Patron	Total
Resident.....	449	39	2	0	490
Nonresident...	152	28	16	0	196
Total.....	601	67	18	0	686

The net changes in membership during the past year are as follows:

	Regular	Retired	Honorary	Patron	Total
Resident.....	+17	+2	0	0	19
Nonresident...	− 4	+2	0	−1	− 3
Total.....	+13	+4		−1	+16

During the Academy year 1946 the Board of Managers held 6 meetings, with an average attendance of 20 persons. The following important matters were considered by the Board:

1. *The first A.A.A.S. grants-in-aid to be awarded by the Washington Academy of Sciences.*—These first grants were made to ANGUS MACIVOR GRIFFIN, associate professor in the Department of Bacteriology, Hygiene, and Preventive Medicine, George Washington School of Medicine, and to R. M. TATUM, U. S. Naval Academy, Annapolis, Md. The grant of $429 to Dr. GRIFFIN was for the purchase of equipment needed in making phase microscopy observations of entozoic Protozoa to further his researches in the borderline between the intestinal Protozoa and bacteria. The grant of $50 to Mr. TATUM was to aid in completing a comprehensive survey of Indian petroglyphs throughout the United States. The Board of Managers requested Dr. GRIFFIN and Mr. TATUM to submit to the Academy reports on their work in the form of papers suitable for consideration by the Editors for publication in the JOURNAL OF THE WASHINGTON ACADEMY OF SCIENCES. The Board feels some notice of work supported by the grants-in-aid should be taken by the JOURNAL even if it is only an abstract.

2. *The increase in dues of resident members from $5 to $6.*—The George Banta Publishing Co., printer of the JOURNAL OF THE WASHINGTON ACADEMY OF SCIENCES, acting within its rights, canceled, effective June 1, 1946, its contract with the Academy in force since January 2, 1942, for the printing and mailing of the JOURNAL. Thereupon, the George Banta Publishing Co. proffered the Academy a new contract with increased costs to the Academy. This was presumably the result of increased costs for labor and materials. The Senior Editor of the JOURNAL after consulting the Board of Managers accepted the new contract, inasmuch as it appeared impossible to obtain better prices from any other company for the same quality of material and work.

The cost of printing and mailing the JOURNAL under the new contract is about 25 percent, or $800 per annum, greater than under the old contract. The total cost to the Academy of publishing the JOURNAL on the basis of the new contract, maintaining former standards of size and quality, is about $4,000 per annum. This does not include direct charges to authors. The total income of the Academy in 1945 exclusive of charges to authors was $4,901.16, of which $2,776.25 was derived as dues from members, $1,099.25 from returns on invested funds of the Academy, $925.54 from non-member subscriptions to the JOURNAL, $100.12 from sale of miscellaneous back numbers of the JOURNAL.

The Board of Managers, at the meeting on May 13, 1946, voted the following measures to increase the income of the Academy:

1. To raise the price of annual nonmember subscriptions of the JOURNAL from $6 to $7.50. In May the JOURNAL had 185 nonmember subscriptions.

2. To raise the price of back numbers of the JOURNAL from $6 per volume to $10 per volume for volumes 1 to 15, $8 per volume for volumes 16 to 22 and $7.50 per volume for volumes 23 to the current issue. The costs of separate numbers are increased in proportion. At present the Academy has only 3 complete sets of the JOURNAL for sale. In addition to these there are only 11 other sets complete from volume 11 to the current issue.

3. To submit to the members of the Academy an amendment to the bylaws of the Academy raising the annual dues of resident members from $5 to $6. Academy members voted 157 to 38 for adoption of this amendment.

During the Academy year, eight meetings of the Academy were held as follows, beginning with the 339th meeting and ending with the 346th meeting:

On February 21, 1946, JOHN E. GRAF, as retiring president presented an address entitled *National responsibility for research* (published in this JOURNAL **36**: 101–110. 1946).

On March 21, 1946, the 1945 Academy Awards for Scientific Achievement were presented to HENRY K. TOWNES, Bureau of En-

tomology and Plant Quarantine, for work in the biological sciences; to KENNETH L. SHERMAN, Department of Terrestrial Magnetism, for work in the engineering sciences; and to ROBERT SIMHA, National Bureau of Standards, for work in the physical sciences.

On April 18, 1946, V. K. ZWORYKIN, director of the Electronic Research Laboratory, Radio Corporation of America, Princeton, N. J., addressed the Academy on *Recent developments in television.*

On May 16, 1946, IGOR I. SIKORSKY, engineering manager of Sikorsky Aircraft Division, United Aircraft Corporation, addressed the Academy on *The helicopter and its place in modern transportation.*

On October 17, 1946, DEAN B. COWIE, Department of Terrestrial Magnetism, addressed the Academy on *Radioactive tracer studies in medicine and biology.*

On November 21, 1946, Capt. CHARLES BITTINGER, U.S.N.R., addressed the Academy on *Camouflage, 1917–1918 and 1941–1945.*

On December 19, 1946, LEONARD P. SCHULTZ and J. P. E. MORRISON, United States National Museum, addressed the Academy on *Biology of Bikini and of adjoining atolls.*

On January 16, 1947, WALDO R. WEDEL, United States National Museum, addressed the Academy on *Archeology and the Missouri River Basin development program.*

The April and May meetings were held in the Auditorium of the United States National Museum. All other meetings were held in the Assembly Hall of the Cosmos Club.

F. G. BRICKWEDDE, *Secretary.*

REPORT OF THE TREASURER

CASH RECEIPTS AND DISBURSEMENTS

RECEIPTS		
From dues, 1944	$ 5.00	
From dues, 1945	100.00	
From dues, 1946	2,760.00	
From dues, 1947	26.00	$ 2,891.00
From JOURNAL, Subscriptions, 1942	$ 7.40	
From JOURNAL, Subscriptions, 1943	11.40	
From JOURNAL, Subscriptions, 1944	12.90	
From JOURNAL, Subscriptions, 1945	45.53	
From JOURNAL, Subscriptions, 1946	760.10	
From JOURNAL, Subscriptions, 1947	510.18	
From JOURNAL, Subscriptions, 1948	5.10	1,352.61
From JOURNAL, Reprints, 1945	$ 264.95	
From JOURNAL, Reprints, 1946	342.40	607.35
From JOURNAL, Sales		798.20
From JOURNAL, Overpayment on Sales		0.20
From Directory, 32nd Edition (1941)		0.50
From Interest & Dividends		990.00
Total Receipts		$ 6,639.86
Cash Balance, Jan. 1, 1946		3,462.78
Total to be accounted for		$10,102.64

DISBURSEMENTS:	*1945*	*1946*	*Total*
For Secretary's Office	$ 4.50	$ 208.61	$ 213.11
For Treasurer's Office	39.25	176.10	215.35
For Custodian & Subscr. Mgr.	14.65	29.59	44.24
For JOURNAL, Printing & Mailing	249.86	3,014.58	3,264.44
For JOURNAL—Illustrations	22.22	373.41	395.63
For JOURNAL—Reprints	100.55	459.48	560.00
For JOURNAL Office—Clerk	20.00	220.00	240.03
For JOURNAL Office—Postage, Binding, & Misc.	2.57	38.16	40.73
For Meetings Committee	95.30	238.60	333.90

For Debit Memos & Refunds:			
For Refund Dues 1946, F. L. Hess		5.00	5.00
For Check (Hann) returned for lack of funds		5.00	5.00
For Exchange on Puerto Rican check		0.35	0.35
For Exchange on Canadian check		0.61	0.61
Total Disbursements	$548.90	$4,769.49	$ 5,318.39
Cash Balance, Dec. 31, 1946			4,784.25
Total			$10,102.64

RECONCILIATION OF BANK BALANCE

Balance as per cash book, Dec. 31, 1946			$ 4,784.25
Balance as per Amer. Sec. & Trust Co. Statement of Dec. 31, 1946		$4,341.71	
Receipts not deposited		577.82	
Total		$4,919.53	
Checks outstanding, not cashed			
No. 1018	$ 5.41		
No. 1140	5.00		
No. 1144	85.87		
No. 1145	39.00	135.28	$ 4,784.25

INVESTMENTS

Washington Sanitary Improvement Co. (stock)			
Certificate No. 434—100 shares at $10		$1,000.00	
Certificate No. 435—100 shares at $10		1,000.00	
Certificate No. 527— 8 shares at $10		80.00	
Certificate No. 539— 1 share at $10		10.00	
Certificate No. 582—200 shares at $10		2,000.00	$ 4,090.00
Potomac Electric Power Co.			
20 shares, 6% preferred stock—cost			2,247.50
City of New York—3% (Transit Unification) (Due—June 1, 1980)			
Certificate No. D 20186		500.00	
Certificate No. C 71038		100.00	
Certificate No. C 71039		100.00	
Certificate No. C 71040		100.00	800.00
Chicago Railways			
Bond No. 1027—5% Registered for $1,000.00 Due Feb. 1927—$250.00 paid—Bal.			750.00
First Federal Savings & Loan Assn.			
Certificate No. I— 914		$4,000.00	
Certificate No. I—1063		1,000.00	5,000.00
Northwestern Fed. Savings & Loan Assn.			
Certificate No. 1380		$4,500.00	
Certificate No. 1441		500.00	5,000.00
United States Government			
Series G Bonds—No. M 332990 G (Jan. 1942)		$1,000.00	
M 332991 G (Jan. 1942)		1,000.00	
M 332992 G (Jan. 1942)		1,000.00	
M 332993 G (Jan. 1942)		1,000.00	
M 1808741 G (Oct. 1943)		1,000.00	
M 2226088 G (Feb. 1944)		1,000.00	
M 2982748 G (Oct. 1944)		1,000.00	
M 4126041 G (Oct. 1945)		1,000.00	$ 8,000.00

American Security & Trust Co.		
Savings Account		46.87
Total		$25,934.37
Cash Book Balance		4,784.25
Total		$30,718.62
Total Assets Dec. 31, 1945	$29,397.15	
Total Assets Dec. 31, 1946	30,718.62	
Increase	$ 1,321.47	

At the time this report was written (not as of December 31, 1946) there were:
19 members in arrears for 1946
14 members in arrears for 1945 and 1946
2 members in arrears for 1944, 1945 and 1946
6 members in arrears for 1943, 1944, 1945 and 1946
1 member in arrears for 1942, 1943, 1944, 1945 and 1946
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HOWARD S. RAPPLEYE, *Treasurer.*

REPORT OF THE AUDITING COMMITTEE

The accounts of the Treasurer of the Washington Academy of Sciences for the year 1946 were examined by your auditing committee on January 14, 1947.

The Treasurer's report was checked and found to be in agreement with the records. All disbursements had been previously authorized and are supported by vouchers or canceled checks. The securities of the Society were inspected and found to be in agreement with the list given in the report and to have all coupons attached that are not yet due.

The Treasurer deserves the highest commendation for the neat, orderly, and conscientious manner in which he has continued to keep and preserve the financial records of the Academy.

H. E. MCCOMB, *Chairman.*
J. H. TAYLOR.
SAMUEL LEVY.

REPORT OF THE BOARD OF EDITORS

Volume 36 of the JOURNAL shows a continuation of the climb back to the size enjoyed during prewar years. Its 12 issues contained 432 pages, 24 pages more than last year, and the largest since volume 31 (1941), which had 528 pages.

In other ways, too, last year's volume showed a continuing trend toward improvement. Its 65 papers were divided among the various categories as follows:

Sciences	Number of papers 1946	Number of pages 1946	Percentages by pages 1946	Number of pages 1945	Percentages by pages 1945
Biological	40	178.8	41.4	218.0	53.4
Physical	8	78.5	18.2	28.7	7.1
Anthropological	12	114.0	26.4	97.3	23.8
Geological	4	24.2	5.6	22.0	5.4
Other	1	9.5	2.2	3.3	0.8
Obituaries, Proceedings, Notices		23.0	5.3	34.7	8.5
Index		4.0	0.9	4.0	1.0
Totals	65	432.0	100.0	408.0	100.0

These figures show a better balance between the various categories than in the last three years. An increase in papers in the physical sciences is notable, but there still is, however, a noticeable lack of papers in the physical, and especially in the geological sciences, which it is hoped will be at least partly remedied next year.

Two papers in the physical sciences were published in the French language by scientists at the University of Liége, Belgium. We hope that more papers from foreign authors will be forthcoming, not only from Europe but also from the countries of Latin America.

This volume contains the addresses of the retiring presidents of the Academy, the Chemical Society, and the Philosophical Society, 1943 and 1945.

In one aspect a decline was shown in this volume. Of the 65 papers published in the JOURNAL, only 26, or 40 percent, were submitted by members of the Academy, the lowest percentage in many years. This is not a healthy condition, and it is sincerely to be hoped that more members will make an earnest effort to send in worthwhile papers to the JOURNAL.

No significant changes in the numbers of papers published and illustrations used were noted.

The outstanding event in the affairs of the JOURNAL was the notification by the printer of an increase of 25 percent in the cost of the printing, commencing with the June number. Considerable thought was given to the matter, and a meeting was held of the Board of Editors with the Executive Committee. As the rise in cost of materials and labor was undoubtedly felt equally throughout the industry, it was decided that an attempt to seek a more advantageous contract with another establishment would be fruitless. For this reason, and also in view of our long and cordial relationship with the George Banta Publishing Co., it was decided to accept the new contract.

To meet this increase, the Board of Managers authorized an additional appropriation equal to 25% of 7/12 of the annual appropriation for the year (to cover the increased cost of the issues from June to December, inclusive).

The Board of Managers appropriated to the editors for printing, illustrating, and mailing the JOURNAL last year $3,666.67 ($3,200 on original appropriation and $666.67 additional appropriation); for clerical assistance $240; and for postage and incidentals $50.00, a total of $3,956.67. Of this, the $240 for clerical assistance was expended in full, and the postage and incidentals cost $39.96. The total cost of the printing bills was $4,339.27. From this is to be subtracted $781.83, the amount charged to authors for reprints, excess illustrations, and excess typesetting charges. This brings the net cost to the Academy of printing the JOURNAL to $3,557.44, leaving a balance of about $100 to be turned back to the Treasurer. Of the appropriation for postage and incidentals, $10.14 was unexpended.

The editors feel that in the coming years the JOURNAL should attempt gradually to regain its former size of over 500 pages. We feel that for the present this is more important than reducing the present charges to authors for reprints and for excess illustrations, tabular material, and the like. To reach this goal, however, more first-class papers are needed, and in this the JOURNAL must have the whole-hearted support of all the members of the Academy, especially from those academicians in the physical and geological sciences. An ultimate return to a policy of allowing a modest number of free reprints to authors would attract more good papers, and, in the opinion of the editors, seems a crucial policy for a general journal.

It is felt that little saving would be realized by publishing only six issues a year and doubling the size of each number. The JOURNAL is one scientific medium that can promise fairly prompt publication of papers, and such a move would be a step backward from our outstanding position among scientists.

For the coming year we therefore recommend that for printing, illustrating, and mailing the JOURNAL the minimum sum of $4,000 be appropriated; this is equal to last year's appropriation plus the 25 percent increase in costs. We also recommend that the appropriation for clerical assistance be increased from $240 to $300. This rise is consistent with the present economic situation, and during recent years the editorial assistant, Mr. PAUL H. OEHSER, has devoted more and more time to the JOURNAL, enabling the Board of Editors to concentrate on selection and revision of papers and on careful proofreading. His willing co-

operation in giving the JOURNAL the benefit of his experience in editorial work has been indispensable.

The Editors also acknowledge with thanks the assistance of the Associate Editors, and all others who have assisted them in any way. We wish also to mention our gratitude to Mr. IRWIN H. WENSINK, the local representative of the George Banta Publishing Co., whose ever-ready willingness to assist the Editors in ironing out occasional problems is gratefully appreciated.

HARALD A. REHDER.
WILLIAM N. FENTON.
JAMES I. HOFFMAN.

REPORT OF THE CUSTODIAN AND SUBSCRIPTION MANAGER OF PUBLICATIONS

SUBSCRIPTIONS:

Nonmember subscriptions in the United States	119
Nonmember subscriptions in foreign countries	66
Subscriptions at reduced rates:	
Geological Society of Washington at $1.50	22
Others at $2.50	2
Total	209

INVENTORY OF STOCKS AS OF DEC. 31, 1946:

Reserve Sets of the JOURNAL:		
Bound Volumes 1–29 and unbound Volumes 30–36		1 set
Unbound Volumes 1–36		2 sets
Unbound Volumes 11–36		6 sets
Unbound Volumes 16–36		11 sets
Miscellaneous numbers of the JOURNAL	19,222	
Total numbers in the Reserve Sets	7,842	
Grand total of back numbers	27,064	
Proceedings of the Washington Academy of Sciences:		
Volumes 1–13, inclusive (1899–1911)		50 sets

During the year several important changes were made by the Board of Managers concerning the office of the Custodian of Publications:

At its 401st meeting, April 15, 1946, the Board voted to reconsider previous instructions in regard to the sale of complete sets of the JOURNAL. The Board voted to instruct the Custodian and Subscription Manager of Publications to sell complete sets of the JOURNAL only to libraries accessible to the public. This restriction was immediately put into effect by a printed statement on the back of the front cover of the March 15 issue of the JOURNAL.

At its 402d meeting, May 13, 1946, the Board voted to raise the sale price of back numbers of the JOURNAL from Vol. 1 through Vol. 15 to $10 per volume; Vol. 16 through Vol. 22, $8 per volume; and Vol. 23 to current issues, $7.50 per volume; with changes in the prices of *separate numbers* in line with the increases in the prices of the complete volumes, the changes in prices to take effect as soon as the revised schedule of prices could be printed on the back of the cover page of the JOURNAL. These changes were printed in the June 15, 1946 (Vol. 36, No. 6) issue of the JOURNAL, together with the corresponding change of prices for the individual numbers. It was also voted to remove all volumes and numbers of Vol. 1 through Vol. 10 from sale in order to preserve these early volumes for the making of additional complete sets.

At the 402d meeting it was also voted to raise the price of annual subscription from $6 to $7.50, effective January 1, 1947. All subscribers have been notified, and this action has been put into effect.

The price of individual back numbers has been increased to correspond with the prices per volume as voted by the Board. Instead of a flat rate of 50 cents per number, the following prices are quoted:

Vol. 1 to Vol. 10, incl.—not available except in complete sets.
Vol. 11 to Vol. 15, incl. (21 numbers per volume)—$0.70 per no.
Vol. 16 to Vol. 22, incl. (21 numbers per volume)—$0.60 per no.
Vol. 23 to current vol. (12 numbers per volume)—$0.90 per no.
Complete sets, to libraries only (Vol. 1 to Vol. 36, incl.), $311.

Upon receipt of the semi-annual inventory of volumes and numbers stored at Menasha, Wis., we were amazed to learn that owing to an increase in our memberships and subscriptions and shortage of paper we had exhausted all copies of No. 1 of Vol. 36 of the JOURNAL, and were below a safe margin of Nos. 2–7, inclusive. Such a shortage could prevent the sale of a complete set, especially since all volumes after Vol. 16 had been held at 20 complete sets. This matter was brought to the attention of the Board of Managers, who authorized the Custodian to appeal to the members not wishing to retain copies of these numbers of Vol. 36 to donate them to the Academy. Several members quickly responded, giving us 30 copies of the missing No. 1 of Vol. 36 and a comparable amount of the other numbers. The Editors in turn have increased the number of copies to be printed.

SALES AND EXPENDITURES:

During January 1946 one complete set of the JOURNAL (Vol. 1–Vol. 35) was sold to the Library of the Denver Art Museum, Denver, Colo. Throughout the year a considerable increase in the sales of back numbers was realized. Approximately 550 numbers were sold as compared to 200 the previous year.

Sales

1 Reserve Set	$200.50
Net sales of miscellaneous numbers	387.70
Total sales	$588.20

Expenditures

Express charges for shipment of Reserve Set to Denver, Colo.	$ 10.44
Postage and office expenses	14.74
Total expenses	$ 25.18
1946 Budgetary allotment	$100.00
Expenditures for 1946	25.18
Balance	$ 74.82
Net gain for the year 1946	$563.02

F. M. SETZLER, *Custodian and Subscription Manager of Publications.*

REPORT OF THE COMMITTEE OF TELLERS

A total of 262 envelopes were delivered to the Secretary. The count of valid ballots showed the following officers elected:

President, WALDO L. SCHMITT,
Secretary, C. LEWIS GAZIN,
Treasurer, HOWARD S. RAPPLEYE
Board of Managers to January 1950, WILLIAM W. DIEHL and F. G. BRICKWEDDE.

K. L. SHERMAN, *Chairman.*
RAYMOND DAVIS.
FRANK NEUMANN.

Submitted by F. G. BRICKWEDDE, *Secretary.*

412TH MEETING OF BOARD OF MANAGERS

The 412th meeting of the Board of Managers, held in the Cosmos Club, November 24, 1947, was called to order at 8 p.m. by the President, Dr. W. L. SCHMITT. Others present were: H. S. RAPPLEYE, N. R. SMITH, H. B. COLLINS, Jr., W. W. DIEHL, F. L. MOHLER, F. M. SETZLER, W. W. RUBEY, L. E. YOCUM, H. G. DORSEY, C. L. GAZIN, and, by invitation, G. P. WALTON, A. STONE, F. THONE, and H. E. MCCOMB.

The President announced the appointment of an Auditing Committee: F. D. ROSSINI, Chairman, A. H. CLARK, and H. E. MCCOMB.

The Chairman of the Committee on Meetings, G. P. WALTON discussed the manner of introducing the recipients of Academy Awards for Scientific Achievement and suggested that three conditions be imposed: (1) The recipient shall be introduced by an intimate professional associate, the introduction to be limited to 5 minutes. (2) The recipient shall be given 20 minutes to explain the work for which the award was given. (3) If a recipient cannot be present to receive his award, the sponsor for his candidacy shall be invited to accept it for him. The Board voted that these suggestions be complied with.

The Chairman of the Committee on Membership, W. W. DIEHL, presented 18 nominations for resident membership and 2 for nonresident membership. The Board recommended that the names of all Nobel prize winners who have spoken before the Academy be considered individually by the membership committee for honorary membership.

The Chairman of the Nominating Committee, F. L. MOHLER, reported that the following had been nominated for the offices to be filled by balloting by members in December: For President, F. D. ROSSINI; for Secretary, C. L. GAZIN; for Treasurer, H. S. RAPPLEYE; for the Board of Managers to serve from January 1948 to January 1951, E. W. PRICE, W. N. FENTON, F. C. KRACEK, F. M. DEFANDORF.

On his recommendation, the Treasurer, H. S. RAPPLEYE, was authorized to present for redemption a $1,000 Chicago City Railways Co. bond which was being called.

The President reported on the progress of the illustrated "Red Book" in preparation for printing.

The Academy's representative on the Joint Committee on Press Relations (with the D.C. Council of Engineering and Architectural Societies), Dr. THONE, reported the success of the Committee in obtaining the cooperation of four Washington newspaper editors in publishing a weekly calendar of scientific and technical meetings. He urged that information regarding the open meetings be submitted to the Committee on cards provided and that these be in the hands of the Committee by noon Wednesday of the week preceding the meeting.

The meeting adjourned at 9:45 p.m.

C. L. GAZIN, *Secretary.*

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